REMARKS

Pending in the application are claims 1, 2, 4, 5, 7-10 and 12, of which claims 1, 4, 7, 10 and 12 are independent. Claims 3, 6, 11 and 13 have been canceled. Claims 1, 2, 4, 5, 7-10 and 12 have been amended. The following comments address all stated grounds of rejection. The Applicants respectfully urge the Examiner to pass the claims to allowance in view of the remarks set forth below.

Claim Amendments

Claims 1, 2, 4, 5, 7-10 and 12 have been amended. Independent claims 1, 4, 10 and 12 have been amended to incorporate the limitations originally included in their respective dependent claims 3, 6, 11 and 13, now canceled in the pending application. Independent claim 7 has been amended to recite the same limitations as added to claims 1 and 4. Claims 1, 4, 7, 10 and 13 have also been amended to incorporate a detecting means that was originally recited as one of the claim elements in dependent claims 2, 5, 8 and 9. The limitations have been incorporated from the dependent claims originally filed in the pending application. Hence, the Applicants respectfully submit that the amendments do not raise new issues and *should be entered and considered* by the Examiner.

Claim Rejection-Under 35 U.S.C. 112

Claims 1-13 are rejected under 35 U.S.C.§112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventor, at the time the application was filed, had possession of the claimed invention. Applicants respectfully traverse this rejection for the reasons set forth below.

The Examiner indicates that claims 1, 4, 7, 10 and 12 recite that the temperature and/or flow rate of the cooling medium is controlled depending on the change of the

amount of *water discharged from the fuel cell*, which is not supported in the originally filed application. The Examiner also indicates that the specification and drawings disclose sensors for measuring various temperatures and the fuel cell electrical output, not the amount (i.e., flow rate) of *water discharged from the fuel cell.*

Applicants respectfully submit that the amended claims are supported in the specification and drawings of the pending application. The claim term water recited in claims 1, 4, 7, 10 and 12 refers to the "separated water" which the *discharged components* are separated into by the gas/liquid separator, not the "discharged water" discharged from the fuel cell. The separated water is the water which has passed *through the condenser*. The separated water is also referred to as "condensed water" in the specification of the pending application. Thus, the separated water should be distinguished from the discharged water that is simply discharged from the fuel cell prior to being condensed.

Although the claims can be read as set forth above, Applicants have amended claim 1, 4, 7, 10 and 12 to clarify the understanding of the term water recited therein. This amendment has not been made in relation to the patentability of the present invention, but to clarify the meaning of the term water. Based on the amended claims, the control of the cooling medium temperature or flow rate is performed based on the separated water which the discharged components are separated into by the gas/liquid separator.

Applicants submit that this feature is supported in the specification of the pending application. First, the gas/liquid separator corresponds, for example, in one non-limiting embodiment to a condenser, as described on page 5, lines 11-13 of the specification. The condenser separates the discharged components discharged from the fuel cell into gas and water (i.e., separated water). The separated water also corresponds to the condensed water produced by the condenser.

The operation condition of the fuel cell is detected by detection means (see page 7, lines 1-3 of Applicants' specification), and the amount of condensed water is determined by the detection means (see page 10, lines 12-14 of Applicants' specification). Further, on page 10, lines 15-17 as well as in FIG. 2, the amount of condensed water is proportional to the fuel cell output. Thus, the amount of condensed water changes depending on the operation condition of the fuel cell detected in the detection means.

Further, as depicted in the flow chart of FIG. 6, and described on page 13, line 26 through page 14, line 2 of Applicants' specification, the number of revolutions of the pump is determined depending on the changes in the amount of condensed water. Additionally, the flow amount of cooling water is variable in the pump. (*see* page 6, line 27 through page 7, line 1) Therefore, the specification of the pending application supports the claim recitation that the flow amount of the cooling medium is controlled depending on the amount of separated or condensed water.

In light of the arguments set forth above, Applicants submit that the specification of the pending application adequately supports the claimed feature that the flow amount and temperature of the cooling medium are controlled in accordance with the changes in the amount of separated or condensed water, simply referred to as water. Therefore, Applicants respectfully request the withdrawal of the Examiner's rejection of claims 1-13 under 35 U.S.C. 112, first paragraph.

Art Rejection-Claims 1-4, 7, 8 and 10-13

Claims 1-4, 7, 8 and 10-13 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Application Publication No. 6-176784 (the '784 publication) in view of U.S. Patent No. 5,346,778 of Ewan et al. (the '778 patent). Claims 3, 11 and 13 have been canceled, and claim 1, 2, 4, 7, 8, 10 and 12 have been amended. Applicants respectfully submit that the pending claims 1, 2, 4, 7, 8, 10 and 12 are not obvious in view of the combination of the '784 publication and the '778 patent.

The '784 publication relates to a phosphoric acid fuel cell employing a phosphoric acid electrolyte. The '784 publication teaches a way to *extend* the service life of the ion exchange resin by keeping constant the cooling water temperature supplied to the condensation heat exchanger regardless of the changes of the air temperature. The '784 publication teaches that the flow rate of cooling water supplied to the condensation heat exchanger is controlled depending on the temperature of cooling water supplied to the condensation heat exchanger.

The '778 patent teaches a load management system for hydrogen-oxygen fuel cell for powering vehicles. Under normal load conditions, air is provided as the oxidizing agent for the hydrogen fuel. At high output conditions, the air supply is enriched with additional oxygen. The system has means responsive to the amperage output from the fuel cell stack to activate valve means for the addition of pure oxygen into the air inlet line.

In comparison, the claimed invention teaches that the amount of separated water changes depending on the operation condition of the fuel cell, and the amount of cooling water is controlled depending on the amount of separated water. In particular, the claimed invention recites that the operation condition of the fuel cell is detected by detecting means for detecting one of a current value or voltage value from the fuel cell, temperature of the discharged components introduced into the gas/liquid separator, temperature of the gas components discharged from the gas/liquid separator, and temperature of the water recovered by the gas/liquid separator.

Applicants respectfully submit that, either singly or in combination, the '748 publication and the '778 patent fail to teach or suggest that the amount of separated water changes depending on the operation condition of the fuel cell, or that the amount of cooling water is controlled depending on the amount of separated water, as recited in independent claims 1, 4, 7, 10 and 12. Rather, the '748 publication teaches that the cooling water temperature varies seasonally and is measured and controlled to be

constant regardless of the changes of the air temperature. The '784 publication fails to teach that the cooling water temperature is controlled depending on the separated water the amount of which changes depending on the operation condition of the fuel cell.

The '778 patent teaches a load management system for fuel cell. The '778 patent discloses a structure including a flow amount sensor (126) for water generated by the fuel cell (1 and 2), a controller (140), and a cooling medium pump (75). The programmable controller receives input signals from the temperature probes (114, 116 and 118) located in the exit lines from the air and hydrogen sides and the cooling water system of the fuel cells. The controller also monitors the water flow rate from the stacks by flow sensor (126). The '778 patent fails to disclose condensed water which the discharged components discharged from the fuel cells are separated into by a gas/liquid separator. Accordingly, the '778 patent fails to teach that the amount of condensed water changes depending on the operation condition of the fuel cell, and fails to teach that the amount of cooling water is controlled depending on the amount of separated water.

In light of the aforementioned arguments, Applicants respectfully submit that the cited prior art of the '748 publication and the '778 patent fail to teach or suggest all of the claim limitations of independent claims 1, 4, 7, 10 and 12. Claims 2 and 8, which depend from claim 1 and 7, respectively, are not rendered obvious over the cited prior. Applicants therefore request the withdrawal of the Examiner's rejection of claims 1-4, 7, 8 and 10-13 as being unpatentable over the '748 publication and the '778 patent.

Art Rejection-Claims 5, 6 and 9

Claims 5, 6 and 9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Application Publication No. 6-176784 (the '784 publication) in view of U.S. Patent No. 5,346,778 of Ewan et al. (the '778 patent) and U.S. Patent No. 6,087,028 of Goto (the '028 patent). Claim 6 has been canceled. Applicants respectfully submit that pending claims 5 and 9 are not obvious in view of the combination of the '784 publication, the '778 patent and the '028 patent.

The '028 patent teaches a method of regulating temperature in a fuel cell system. The '028 patent teaches that cooling water heated by heat exchange carried out in a fuel cell (22) is subsequently cooled by a radiator (26). The temperature and flow rate of the cooling water are controlled by the fan (24) in the radiator system.

Applicants respectfully submit that the '028 patent also fails to teach or suggest that the amount of separated water changes depending on the operation condition of the fuel cell and the amount of cooling water is controlled depending on the amount of condensed water, as recited in independent claims 4 and 7 from which claims 5 and 9 depend respectively. The '028 patent discloses a radiator system in which the temperature of the water discharged from fuel cells (22) is controlled by a radiator (26) and a fan (24) driven by a control unit (50) depending on the difference of the temperatures detected at the temperature sensors (32 and 34). The '028 patent fails to teach that the temperature of the cooling water is controlled depending on the amount of separated water, the amount of which changes depending on fuel cell operation conditions.

In light of the arguments set forth above, the '748 publication, the '778 patent and '028 patent also fail to teach or suggest all of the claim limitations of claims 4 and 7. Claims 5 and 9, which depend from claim 4 and 7, respectively, are not rendered obvious over the cited prior art. Applicants therefore request the withdrawal of the Examiner's rejection of claim 5, 6 and 9 as being unpatentable over the '748 publication, the '778 patent and '028 patent.

Conclusion

In light of the aforementioned arguments, Applicants contend that each of the Examiners rejections have been adequately addressed and the pending application is in condition for allowance.

Attached hereto is a marked up version of the changes made to the claims by the current amendment. The attached page is captioned **"Version With Markings To Show Changes Made".** Should the Examiner feel that a telephone conference with Applicants' attorney would expedite prosecution of this application, the Examiner is urged to contact the Applicants' attorney at (617) 227-7400.

Respectfully submitted,

Date: December 26, 2002

LAHIVE & COCKFIELD, LLP
Attorneys at Law

By _____

Anthony A. Laurentano
Reg. No. 38,220
28 State Street
Boston, MA 02109
(617) 227-7400
(617) 742-4214

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Please cancel claims 3, 6, 11 and 13.

Please amend claims 1, 2, 4, 5, 7-10, and 12 as follows:

1. (Twice Amended) A fuel cell system provided with a fuel cell including an anode electrode disposed opposingly with an electrolyte interposed there between, for obtaining electromotive force by supplying fuel gas containing hydrogen to said anode electrode while supplying oxygen-containing gas containing oxygen to said cathode electrode, said fuel cell system comprising:

a gas/liquid separator for separating discharged components discharged from said fuel cell into gas components and water, an amount of said water which said discharged components are separated into by said gas/liquid separator being changed depending on an operation condition of said fuel cell; and

a flow rate control unit for controlling a flow rate of a cooling medium supplied to said gas/liquid separator for performing heat exchange with said discharged components,

wherein the flow rate of said cooling medium is controlled depending on the amount of said water, and said operation condition of said fuel cell is detected by detecting means for detecting at least any one of a current value or voltage value from said fuel cell, temperature of the discharged components introduced into said gas/liquid separator, temperature of said gas components discharged from said gas/liquid separator, and temperature of said water recovered by said gas/liquid separator.

2. (Amended) The fuel cell systems according to claim 1, wherein said flow rate control unit includes:

a pump for varying said flow rate of said cooling medium supplied to said gas/liquid separator; and

[detecting for detecting said operation condition of said fuel cell, and]

a control unit for controlling output of said pump on the basis of information detected by said detecting means.

4. (Twice Amended) A fuel cell system provided with a fuel cell including an anode electrode and a cathode electrode disposed opposingly with an electrolyte interposed therebetween, for obtaining electromotive force by supplying fuel gas containing hydrogen to said anode electrode while supplying oxygen-containing gas containing oxygen to said cathode electrode, said fuel cell system comprising:

a gas/liquid separator for separating discharged components discharged from said fuel cell into gas components and water, an amount of said water which said discharged components are separated into by said gas/liquid separator being changed depending on an operation condition of said fuel cell ; and

a temperature control unit for controlling a temperature of a cooling medium supplied to said gas/liquid separator for performing heat exchange with said discharged components,

wherein the temperature of said cooling medium is controlled depending on the amount of said water, and said operation condition of said fuel cell is detected by detecting means for detecting at least any one of a current value or voltage value from said fuel cell, temperature of the discharged components introduced into said gas/liquid separator, temperature of said gas components discharged from said gas/liquid separator, and temperature of said water recovered by said gas/liquid separator.

5. (Amended) The fuel cell system according to claim 4, wherein said flow rate control unit includes:

a radiator arranged for a piping tube for circulating and supplying said cooling medium to said gas/liquid separator;

a cooling fan provided together with said radiator; and

[detecting for detecting said operation condition of said fuel cell, and]

a control unit for controlling output of said cooling fan on the basis of information detected by said detecting means.

7. (Twice Amended) A fuel system provided with a fuel cell including an anode electrode and a cathode electrode disposed opposingly with an electrolyte interposed therebetween, for obtaining electromotive force by supplying fuel gas containing hydrogen to said anode electrode while supplying oxygen-containing gas containing oxygen to said cathode electrode, said fuel cell system comprising:

a gas/liquid separator for separating discharged components discharged from said fuel cell into gas components and water, an amount of said water which said discharged components are separated into by said gas/liquid separator being changed depending on an operation condition of said fuel cell; [and]

a flow rate control unit for controlling a flow rate of a cooling medium supplied to said gas/liquid separator for performing heat exchange with said discharged components, the flow rate of said cooling medium being controlled depending on the amount of said water; and

a temperature control unit for controlling a temperature of a cooling medium depending on the amount of said water,

wherein said operation condition of said fuel cell is detected by detecting means for detecting at least any one of a current value or voltage value from said fuel cell, temperature of the discharged components introduced into said gas/liquid separator, temperature of said gas components discharged from said gas/liquid separator, and temperature of said water recovered by said gas/liquid separator.

8. (Amended) The fuel cell systems according to claim 7, wherein said flow rate control unit includes:

a pump for varying said flow rate of said cooling medium supplied to said gas/liquid separator; and

[a detecting means for detecting said operation condition of said fuel cell, and]

a control unit for controlling output of said pump on the basis of information detected by said detecting means.

9. (Amended) The fuel cell system according to claim 7, wherein said flow rate control unit includes:

a radiator arranged for a piping tube for circulating and supplying said cooling medium to said gas/liquid separator;

a cooling fan provided together with said radiator; and

[a detecting means for detecting said operation condition of said fuel cell, and]

a control unit for controlling output of said cooling fan on the basis of information detected by said detecting means.

10. (Twice Amended) A gas/liquid separation method for a fuel cell system for supplying, to a gas/liquid separator, discharged components discharged from a fuel cell including an anode electrode and a cathode electrode disposed opposingly with an electrolyte interposed therebetween, and separating said discharged components into gas components and water, an amount of said water which said discharged components are separated into by said gas/liquid separator being changed depending on an operation condition of said fuel cell, said method comprising the steps of:

detecting changes in the amount of said water ; and

controlling a flow rate of a cooling medium supplied to said gas/liquid separator for performing heat exchange with said discharged components, depending on said changes in the amount of said water,

wherein said operation condition of said fuel cell is detected by detecting means for detecting at least any one of a current value or voltage value from said fuel cell, temperature of the discharged components introduced into said gas/liquid separator, temperature of said gas components discharged from said gas/liquid separator, and temperature of said water recovered by said gas/liquid separator.

12. (Twice Amended) A gas/liquid separation method for a fuel cell system for supplying, to a gas/liquid separator, discharged components from a fuel cell including an anode electrode and a cathode electrode disposed opposingly with an electrolyte interposed therebetween, and separating said discharged components into gas components and water, an amount of said water which said discharged components are separated into by said gas/liquid separator being changed depending on an operation condition of said fuel cell, said method comprising the steps of:

detecting changes in the amount of said water; and

controlling a temperature of a cooling medium supplied to said gas/liquid separator for performing heat exchange with said discharged components, depending on said changes in the amount of said water,

wherein said operation condition of said fuel cell is detected by detecting means for detecting at least any one of a current value or voltage value from said fuel cell, temperature of the discharged components introduced into said gas/liquid separator, temperature of said gas components discharged from said gas/liquid separator, and temperature of said water recovered by said gas/liquid separator.